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REPORT

ON THE

PETROLEUM DISTRICTS

SITUATED ON THE RED SEA COAST

BY

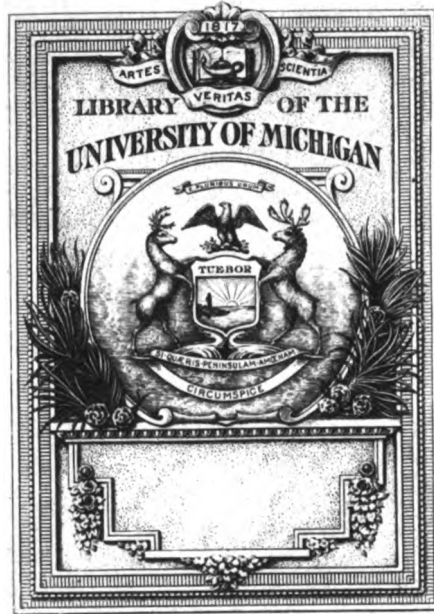
COLONEL C. E. STEWART C.B. C.M.G. C.I.E.



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1888



THE GIFT OF
W. J. Hussey



Egypt. Public work. 1888.

196

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COLONEL C. E. STEWART C.B. C.M.G. C.I.E.



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REPORT

ON THE

PETROLEUM DISTRICTS

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Under instructions received from Col. Sir Colin Scott Moncrieff, Under Secretary to the Government, Public Works Department, I left Cairo on the 16th of December for the purpose of reporting on the petroleum district, situated on the Red Sea coast. I reached Suez by train the same evening and embarked on board the steamer "Mansourah" which left at 10 p. m. for Jamsah. Jamsah is situated on the African coast of the Red Sea, near the mouth of the Gulf of Suez. The "Mansourah" did not reach her destination on the 17th as I had been led to expect, the day being so fine, the captain said he could not see the reefs, which are apparent when there is a slight swell. We anchored for the night, and on the morning of the 18th I landed. The little settlement known as Jamsah is situated on a peninsula of the same name, jutting out from the African coast.

M. de Bay was engaged here in 1885 to make researches for petroleum. He proceeded to Belgium for the purpose of purchasing the necessary tools and apparatus for drilling, and after some time boring at Jamsah was commenced. M. de Bay's No 1 well was, as far as I could ascertain, drilled to a depth of 62 mètres, 95 centi-mètres, and the iron piping used in it was of a diameter of 24 centi-mètres. His No 2 well, drilled also at Jamsah, within a very short distance,

of his No 1 well, was bored to a depth of 28 mètres, 95 centi-mètres and cased with iron piping of 27 centi-mètres diameter. A third well was sunk by M. de Bay on the sea coasts, on the same peninsula, about $1\frac{3}{4}$ miles from the settlement of Jamsah. This well was drilled to a depth of 32 mètres, 92 centi-mètres. As far as I could ascertain, No 2 well of M. de Bay, produced oil only in very small quantities, and No 3 none at all. His No 1 well is said to have overflowed, and was believed by those present to contain an unlimited supply of oil. I was informed by a person still at Jamsah, that he was present on that occasion, and that the oil rose up in the pipe and overflowed and this statement is borne out by many witnesses.

Great hopes were raised in consequence of the finding of this oil. M. de Bay's No 1 still produces a small quantity of oil. I have not been able to procure any data as to the strata through which his borings were made, but as this well is only 41 feet distant from one bored later by the American borers to a depth of more than 400 feet, the strata through which the boring tool passed were probably of a similar character, to those shown at similar depths, in well No 1 in the annexed diagram. I have no doubt that the flow of oil and gas in M. de Bay's well, was caused by the drilling tool piercing a crevice in the rock, which contained a certain quantity of petroleum and gas, which the gas forced up to the surface. Such occurrences are very common in boring for petroleum, and raise the hopes of the drillers without really much cause. In Russia I have known what proved to be a most unsatisfactory well, suddenly, while being bored to throw up a column of petroleum to the amount of 50,000 gallons and then stop, the well never producing anything more and proving a failure.

These wells of M. de Bay's were firmly closed up and abandoned. One had been reopened previous to my arrival at Jamsah, and I opened and inspected the other. After M. de Bay's departure, new arrangements were made for prosecuting the work with vigour, and American, Russian and Roumanian borers were imported and

the work pushed on. Five wells were drilled at Jamsah by the Americans and others, all within a comparatively small area. I visited and examined these wells. Two of them seemed to me to be of superior interest to the others. I will first consider No 2 well, which, having been drilled to a depth of 2,120 feet, is for my purpose of superior value to the others, which were given up at comparatively small depths. It will be observed that the following were the strata through which the borings were made: —

1. Gypsum.
2. Indurated limestone.
3. Blueish drab clay, sulphurous.
4. Gypsum.
5. Limestone with sulphur.
6. Blueish grey marl, sulphurous.
7. Dark brown indurated limestone with a little petroleum.
8. Blueish grey indurated limestone, with traces of petroleum.
9. Blue clay with gypsum specs and no dules some traces of oil.
10. Gypsum with some asphalt.
11. Very dark fine grey sandstone.
12. Gypsum.
13. Blue clay with petroleum.
14. Gypsum with petroleum.
15. Light coloured gypsum, sometimes highly indurated, approaching alabaster in character, more or less impregnated with petroleum and gas.

At several points between 975 — 2,012 feet, petroleum oozed into the bore; this oozing of petroleum between 2,000 and 2,012 feet was very considerable; the greatest inflow having been at 1,310 feet. At 2,120 feet when the boring ceased there was no sign of oil; only gas was found. In the whole of this boring to a depth of 2,120 feet no sandstone was drilled through, except at one point between 740 and 760 feet, where a comparatively thin layer of a very fine grained sandstone was passed through but this contained no oil. There is no record that there were ever any traces of oil in

this sandstone, although a considerable quantity of oil was found in the strata below it. In reading this report reference should be made to the coloured sections of these wells, furnished with it, otherwise it may be difficult to follow.

In No 1 well of the Americans, which was drilled within 41 feet of the No 1 well of M. de Bay, the strata passed through were as follows :

1. Gypsum with a little sulphur.
2. Grey indurated limestone.
3. Marl.
4. Dark grey indurated limestone, with fissures containing petroleum in considerable quantity.
5. Greenish grey clay.
6. Limestone saturated with petroleum.
7. Greenish grey marl, with at 265 feet, a 6 inch layer of ozokerit.
8. Grey limestone with some petroleum.
9. At 370 feet several thin layers of ozokerit.

This well was abandoned after being drilled to a depth of about 400 feet. In neither of these wells was any sandstone found, except in No 2, at one single point. Now it is well known, that the strata containing oil in large quantities are almost invariably some form of sandstone or sand. The sandstone, in which the oil occurs, varies much in quality and appearance, often consisting of coarse sandstone containing many pebbles of quartz, so as not unfrequently to form a sandstone conglomerate. Where oil is found in shale or rock other than sandstone, it is generally either present in comparatively small quantities, as in the Scotch shales, or else, as in the case of the Slush oil wells of America, though a considerable quantity of oil is given out for a short period, the well soon runs dry. It is also believed, that in the case of the Slush oil wells, the supply has been drawn through fissures from other rocks. It is the object of oil seekers to find petroleum in the sandstone reservoirs in which nature has stored it. Such pools of oil, as they are called by borers,

are almost always in sandstone, and this word "pool" is used to convey the meaning of a quantity of oil stored in a porous sandstone, or sand strata, and isolated by other strata of rock or soil impervious to petroleum, or through which it can only penetrate in very small quantities. This rule of oil usually being found in paying quantities only in sandstone or sand holds good in the United States, where the oil supply is chiefly drawn from the sandstone strata at the top of the Devonian system, or in the sandstone of the transition beds formed while the Devonian was merging into the Carboniferous. Equally in the Crimea, on the Black Sea coast near Novo-Rassisk, and on the Caspian Sea coast near Baku, it is in sandstone or sand alone that petroleum is found. In these last countries however, the oil is found in a Tertiary sandstone formation, and not in the older formations as in the United States. I am only aware of one single exception to this general rule and that is in Canada, where petroleum has been found in a limestone formation. But there appears to be local reasons for this exception, which need not be entered into here.

From the above it is evident, that if we wish to ensure a paying supply of oil, we must sink our wells to such a depth, as to reach sandstone strata. My efforts were therefore particularly directed to discover at what depth such a sand stone strata could be found. Here the geological knowledge of Mr Mitchell, the mining engineer in the service of the Egyptian Government, who accompanied me in my journeys and helped me, was most useful. He pointed out, in a deeply eroded ravine near Ras Dhib, which we visited together, that the sand lay at least 1,000 feet below the strata reached by the deepest boring as yet made at Jamsah, 2,120 feet. It does not follow that this sandstone would be found at exactly the same depth at Jamsah, as near Ras Dhib. The depth at which this strata was found might be different, but the probabilities seem to point to the sandstone rock being found at Jamsah at no less depth of boring than 3,000 feet. Also it must be remembered that petroleum would not probably be found in the uppermost layer of sandstone. We were able to trace near Ras Dhib, and in other

parts of the country, at least 3 different layers of sandstone, and the lowest of these, or even one lying at a lower level still, might have to be reached by the drilling tool before petroleum was found.

For this reason it must be evident, that though the surface indications of petroleum at Jamsah are very good, and it was a place, where it was, in consequence, necessary to make trial borings, I consider that amply sufficient has been done to show that the prospect of finding petroleum in large quantities at this point does not seem encouraging, and that it would not therefore be advisable to sink No 2 well, already bored to 2,120 feet, any deeper. My advice would be to try some other point, where there were petroleum indications, and where the beds of sandstone were nearer the surface. As a broad principle I would say this, but the signs of petroleum in No 1 well, shown in annexed diagram, which was abandoned at a depth of about 400 feet, (I understand in consequence of an accident preventing further drilling), were so promising, that it might be considered worth while, to drill another well beside it, to a depth of 700 feet, especially as this well is close to M. de Bay's well which was of good promise, in the hope that a fissure might be struck, which contained petroleum in considerable quantity. Such a procedure might prove successful. However if a fissure were struck, the well would probably only give a supply of oil for a comparatively short period, and I should not myself recommend it.

There is another reason, beside the expense, why very deep borings are to be avoided. To understand this we must consider what petroleum is. Different sorts of petroleum seem to have had very different origins. The majority of the oils found in the oil districts of the United States, though there are considerable varieties amongst them, seem probably to be distillates of vegetable substances, the distillation having taken place in the earth, under considerable pressure. Californian and some other petroleums, seem to be the result of distillation acting upon the remains of minute sea animals, and thus may be considered of animal origin. Professor Mendelejeff, in a paper read before the Chemical Society

of St Petersburg on the 25th February 1887, gave in detail his reasons for believing petroleum to be the result of the action of super-heated steam, acting under great pressure, in the bowels of the earth, upon iron, manganese and carbon, and he altogether contests the possibility of petroleum being of purely vegetable or animal origin, and thus attempts to prove that it is of mineral origin. Probably he was referring especially to Russian petroleum. Some experiments carried on in 1877-78 by Mr Cloez would seem to bear out this idea, as he succeeded in obtaining hydrocarbons resembling certain constituents of petroleum, as a result of the action of dilute sulphuric acid on a carbide of iron and manganese. In 1878, by using a carbide richer in manganese, he succeeded in producing the re-action with boiling water, and obtained the oils as before.

It thus seems probable that the various sorts of petroleum found in the strata of different parts of the earth are of different origin. It does not appear likely that the petroleum found in America in the Devonian and even older strata is the result of the same action as that found in Europe and Western Asia, where it is generally found in sandstone of Tertiary formation. Mr J. F. Carrll, geologist in charge of the survey of the oil regions of Pennsylvania, who has written on the subject of the origin of petroleum brings forward reasons for considering that petroleum was first formed in the form of gas, (though he does not positively assert this), and that then this gas was converted into oil, and he adduces many facts in support of this theory. In his work published at the end of 1880, he states, that up to that time, no well producing petroleum had been drilled to a greater depth than 2,100 feet. Many wells had been drilled to a much greater depth, some to even a depth exceeding 3,500 feet, but these wells were either dry holes producing nothing, or else only produced gas.

I am aware that paying oil wells have since been drilled to a considerably greater depth than 2,100 feet, in the United States, but I believe the prospect of finding oil in paying quantities at great depths is infinitely smaller than at more moderate depths. It is for

this reason that I would strongly advise, that that trial borings should be made at other points than Jamsah; at points, where, by the wearing away of the overlying strata, the sandstone is at the surface or else very little below the surface, and I will proceed farther on to suggest the spots where these trial borings could be made with the greatest prospect of success. The idea, that the failure to find petroleum is simply caused by the well not having been drilled to a sufficient depth is a very common and erroneous one, and borings are often continued after all real hope of finding oil ought to have been abandoned. My advice would be to bore 2 or 3 holes at promising points, to a depth of between 1,000 and 2,000 feet, and thus, at a comparatively small expense, settle the question of the existence of petroleum in paying quantities on the Red Sea littoral.

On the 21st of December I left Jamsah and crossed the Bay of Jamsah to to the opposite headland of Jeb-el-Zayt, where there is a large settlement, many wooden huts having been put up to accomodate the workmen brought in 1886 to carry on the work at Jamsah and Jeb-el-Zayt. Besides the wooden huts, which are of a very superior description, being chiefly hospital huts which had been used at Suakin, there were two large galvanized iron workshops and store sheds, also a masonry built house, in a part of which, a large ice machine was worked. A large double storied masonry building has also been commenced, but this is as yet quite incomplete. The workshop is well supplied with tools of every description necessary for the contemplated work. A pier has been built out in the harbour of Jeb-el-Zayt, and a short line of railway laid down, connecting it with the workshop. Every preparation has been made for operating on a considerable scale, a large sum having, I understand, been expended by the Egyptian Government in these preparations, and if it was considered desirable to form a Company for the prosecution of the search for petroleum, these workshops and tools would be a very valuable acquisition. The harbour at Jeb-el-Zayt is a good one, though small. A hulk is anchored in the harbour, which was used to house convicts, who were employed in making

the landing pier, but the convicts have long since been withdrawn. The same afternoon I visited the only well that has been drilled in the neighbourhood of Jeb-el-Zayt. It is situated about 2 miles from the landing place and is only just above high water mark, the sea washing close up to it. Close to the spot where this well has been drilled, there are three considerable hollows or holes in the ground, each containing a mixture of water and petroleum. If these were carefully skimmed every few days, three or four tons of petroleum could possibly be obtained in the course of a month. Of course this petroleum mixed with water and exposed to the air, by which all the more volatile portions have been evaporated, gives no real criterion of the quality of the petroleum, as originally held in the earth. I was very anxious to obtain a specimen, which had not been exposed to the air, for analysis, but I was not able to obtain one. I am aware that an analysis has been made of this surface petroleum.

A range of hills of crystalline rock approach the sea at this point within about 700 yards, and the danger of boring here, was that at a very inconsiderable depth, this crystalline rock might be met with, and the search for petroleum beyond that point would be hopeless. There are besides this very serious objections to the drilling of a petroleum well so very close to the sea, just above high water mark which I need not enter into here. However with the surface signs of petroleum so evident, as they were in this spot, an attempt to try the strata below for petroleum was probably necessary. But the records of the well bored at this point abundantly prove, how a mere surface indication of oil cannot be trusted. I have not been able to obtain any specimens of the strata through which this well was drilled, but according to the written record, which I was able to obtain from Sir Colin Scott Moncrieff's office at Cairo, a copy of which is annexed, the strata were as follows : —

1. gravel to 20 feet.
2. 20 to 60 feet, gravel and sea shells with a slight show of oil.
3. White coral with a vein of sulphur water.

4. Coral mixed with gravel.
5. Gypsum.
6. White coral.
7. Coral, white and black.
8. Hard boulder.
9. Soft sand and clay.
10. Gypsum.
11. Black clay.
12. Black coral.
13. Very hard black coral.
14. White and black coral.
15. Salt and pepper coral.
16. Soft white coral.
17. Stone and clay.
18. Stone and coral.
19. Stone and rock.

This well was abandoned, I am informed at a depth of about 706 feet in consequence of having reached the crystalline rocks. The records of this well, as far as they go, are most instructive, as here is an example of a well drilled close by fissures or openings from which free petroleum was exuding in considerable quantity, yet it showed no sign of oil throughout the whole of the boring, except a slight trace in the first 60 feet. The well has been abandoned and the piping withdrawn, except 280 feet of 8 inch pipe, which broke and remained in the hole. The derrick has also been removed and is available for re-erection at any other place at which it may be determined to commence boring.

A long open gallery has been cut from near the sea coast, towards the mountain chain, and much labour has been expended in opening out this gallery to a considerable depth, but without any result as far as petroleum is concerned. I could not ascertain whether this gallery had originally been opened with the view to searching for petroleum or not. I was informed that it had long ago been made in a search for coal. This open gallery has been excavated through a bed of sand and shells.

One thing that struck me in visiting Geb-el-Zayt was the small quantity of petroleum available there. I had expected a much more abundant supply. This place was known to the ancients as producing oil, and Mr Mitchell mentions having found a lamp of pottery ware buried in the ruins of an ancient mining camp, in the neighbourhood of the goldmines of Hammamat, midway between Kennah on the Nile and Kosseir. He states that though this lamp had lain buried probably 2,000 years, it contained petroleum dried down to the consistency of bitumen, which on being lighted, burned readily. He also says niches cut in the sides of the galleries of the subterranean workings, where lamps were placed, together with the surfaces of the surrounding or overhanging rocks blackened with smoke, showed the use made by the ancients of petroleum in lighting up their mines. Petroleum or bitumen, which is only another form of the same substance, must have been used in the preparation of their mummies by the Egyptians, and for many other purposes, which would indicate a large supply of petroleum being available, and whence could it have been obtained? The supply obtainable at Zeitieh would have only gone a little way in supplying the miners at the goldmines of Hammamat, at the copper mines of Jebel Maaden, at the emerald mines of Jebel Zobara all near the Red Sea and presumably at other mines unknown to me, to say nothing of the quantity required in the process connected with embalming. The supply of petroleum procurable from Jamsah would be rather greater than that at Jeb-el-Zayt. But the petroleum at Jamsah was not known to the ancients, having been discovered in 1869. It is equally difficult to think that it was imported from any considerable distance. For burning, and I should think probably also for embalming, liquid petroleum, or the semi-fluid bitumen known as " Maltha " would be required and neither of these could be transported, except with great loss and difficulty in skin bags from a distance, and the distance from which they would have to be brought, would have been very great indeed. I believe no large supply of petroleum, unless it was procured in Egypt or its

neighbouring provinces, could have been procured nearer than on the Euphrates near Babylon, or on the Tigris between Nineveh and Baghdad. This latter spot I have visited, and a large supply was drawn from it in ancient times by the Assyrians, but even if distance had not prevented the Egyptians procuring the necessary supplies of petroleum required by them from Babylonia or Assyria, the terms on which the Assyrians and the Egyptians generally lived, would seem to preclude the probability of a large trade in so bulky a commodity. The supply of any liquid or semi-liquid form of petroleum, procurable from the neighbourhood of the Dead Sea, though no doubt some bitumen was brought from thence, could not, I understand, have been great, and a semi-liquid form would at least be necessary for burning, if not for embalming. We are thus thrown back on the assumption that the Egyptians drew their supplies of petroleum from their own country, and the question arises. “ where was the source of that supply ” ?

CHAPTER II.

On the 23rd of December, Mr Mitchell and I left Zeitieh and went in the steam launch to a point about 3 miles south of Ras Dhib. We landed and pitched our tent near the mouth of a ravine, where the strata had been eroded by water, and where the sandstone formations were exposed. We proceeded up this ravine for some miles and carefully examined it. The limestone rocks, which were here exposed above the ground, when broken, gave off a strong smell of petroleum, and were much impregnated with gas, but no free petroleum was found. The next day we proceeded to Ras Dhib, where we found a stratum of limestone rock, which, not only contained gas, but small quantities of free petroleum which filled cells or cists in the rock. This rock was similar to the rock containing petroleum in cists found in the most promising of the wells at Jamsah, and thus gives hopes that petroleum could be

discovered in paying quantities in this neighbourhood. A specimen of the rock from Ras Dhib is submitted with this report. It would not be advisable to bore a well exactly at this point as the sandstone, when reached, would probably have been distorted and subjected to great heat by the igneous rocks which probably lie underneath, and have been the cause of the tilting of the strata. A boring should, I consider, be made in the Wady a little to the North of West of the point where this petroleum-bearing rock exists, and about three quarters of a mile from the sea coast. I fixed upon a point where I thought it most desirable that a trial boring should be made. I have marked it No 1 on the accompanying map, and Mr Mitchell is aware of the point selected by me. A boring made at this point would probably reach the sand rock at no very great depth, and the sandstone at this point would be reached in its natural bed and not where it had suffered distortion by igneous action.

The presence of free petroleum in the upheaved limestone near by would lead me to expect a successful result of a boring made near the selected point. I spent 3 days in going over the ground in the immediate neighbourhood of Ras Dhib, and then returned to Jeb-el-Zayt and Jamsah. On the 28th of December, Mr Mitchell and I started off to search for petroleum in the great plain situated parallel to the main mountain range, which runs down the interior at a varying distance from the coast line, but which, at the point we reached it, was about 32 miles from the sea. The first day we travelled some 25 miles and halted near a white conical hill, in what is called the Limestone Range in the Geological Survey Map made by Mr Mitchell, and printed for the Government. This round white hill, in the neighbourhood of which we remained the following day also, is a very conspicuous object. Not far from this hill the sandstone stratum is exposed on the surface, or is found at a very inconsiderable depth beneath it, and I fixed on a point about one mile North-North East from the round white hill, where it would be desirable that a trial boring should be made. This spot is marked in Mr Mitchell's Geological Map, which is submitted with this Report as No 2.

On the 30th of December we proceeded to the well of Bir Abu Nakl about 2 miles south, from which well I fixed upon another point at which it would also be desirable that a trial boring should be made. This is marked on the Map as No 3. From the well of Bir Abu Nakl we proceeded to the mountain Jebel Mangool in the main range, where there is a small well of good water. The country passed over showed in many places the sandstone rock exposed to the surface, or lying at a very small depth below it. Three different layers of sandstone were traced at various points, all belonging to geological periods older than the Tertiary. No free petroleum was found, but these strata were a continuation of the formations of sandstone which were found near Ras Dhib, and in the limestone super-imposed on which both free petroleum in cists and much petroleum gas was found.

As to water for the borers and engine employed at the trial borings I have recommended to be made, the one, near Ras Dhib, could be supplied with water brought from the village of Tor on the opposite coast, by country boat, or one of the small stills for distilling water now at Jamsah could be set up on the sea coast near Ras Dhib, and could supply what was required for a small party, which would be all that was necessary.

For the boring marked N° 2, near the white round topped hill, water would have to be brought from the well at Abu Nakl by camels, a distance of about eleven miles. There are two wells at Bir Abu Nakl which give an unlimited supply of water. If it was considered necessary, other wells could be dug, as the water bearing area is large, and hardly any labour is required, the water being found within some 5 feet of the surface. I calculated 10 camels, if properly provided with barrels, could bring the necessary supply of water for one steam engine and a crew of 9 men in all, though the number of camels required would be very much greater if water-skins were used in the wasteful manner of the country. The water at Bir Abu Nakl is very slightly brackish, but quite drinkable. If it was considered necessary to bring a small quantity of perfectly

good water for drinking purposes, one camel could be sent daily to the well of Jebel Mungool which is situated at a little less distance than the well of Bir Abu Nakl, but in another direction, where the water is perfectly pure. This water, however, could only be supplied in small quantities for drinking alone, as the road to the Mungool well is a bad one, and the quantity available is small, though permanent. It is in porphyry rock, on a mountain side, 15 camels can drink the Mungool well dry. A camel when thirsty can drink about 18 gallons, so the capacity of the Mungool well may be taken roughly at 270 gallons. It takes about 5 hours when emptied to refill. I have pointed out to Mr Mitchell a spot in Wadi Dhib within about 5 miles of No 2 boring, where, I think, water could perhaps be found, and it would be worth while, if No 2 boring was attempted, to sink a hole to 10 feet depth in this Wady as an experiment. If water was not found within 10 feet, it would probably not be found at all, and water would have to be brought from Abu Nakl well as I have above suggested. The water for the boring at No 3 would not be difficult to supply, as it is within a distance of two miles from the well at Abu Nakl.

I consider a boring at No 1 more important than at No 2, and No 2 than No 3, but the question of the presence of petroleum in this part of Egypt will never be satisfactorily settled until trial borings have been made at two at least of these points, and also at Abu Durbah in the Sinai Peninsula. The expense incurred, in carrying out these borings, need not be great. A party, consisting of a head borer and two assistants, with two firemen and four labourers, would be quite sufficient to carry on the work, and the wages of such a party would not amount to any very large sum. Of course a civil engineer would be required to superintend the work, but probably one could be found already in the service of the Egyptian Government with quite sufficient knowledge to superintend this work, having a first class head borer under him for the more technical parts connected with the drilling. When one hole had been drilled, the party might be transferred to one of the other points that I have

indicated for an experimental boring. These trial borings would not require casing with iron pipe except for the first few feet, unless the strata should prove particularly friable, which is unlikely. The well No 2 at Jamsah has been very successfully bored to a depth of 2,120 feet ; nearly 1,200 feet of this depth is without casing. No steam-ship would be required to bring provisions to the small party engaged. The small quantity required could be sent by a native boat, either from Suez, or perhaps arrangements could be made to supply them with provisions from the village of Tor on the coast of the Sinai Peninsula, where we found no difficulty in purchasing provisions for our desert trip. At these borings no difficulty would be found in supplying coal, as it could be landed from a steamer on the coast, near the Ras Dhib boring, and also near the proposed boring at Abu Durbah north of Tor. The quantity of coal considered necessary for the whole boring and for distilling water, with the smallest still now at Jamsah, if distilling was considered necessary, which I do not think it would be, could be landed all at once. The small still, distils 750 gallons a day, which would be sufficient for one engine and a party of nine men. A native engineer and a couple of men would be required in addition to the above for the distilling work, if it was decided to distil water and not bring it by country boat. The steam launch would be required to be kept up for the use of the engineer who superintended the work, and who would live at Zeitieh or Tor, according as the work was to be done at Ras Dhib or Abu Durbah. I would not propose that any buildings should be put up, either at Ras Dhib, or at the places where the trial borings were made. The work could be carried on in the winter, and the men could live in tents. The borings need not be of great diameter, a boring of 10 inch diameter at the commencement, reduced to 8 inches or even 6 inches lower down, would be amply sufficient as a test. The greatest depth, to which the borings would require to be made, would be at the most 2,000 feet, though, I believe, the question as to the existence of petroleum in this part of Egypt could be finally set at rest by boring to a less depth than that.

From the 1st to the 3rd of January, I travelled over the desert country between Mungool Well and Mai Masaid Well visiting Kufra, but, finding no sign of free petroleum, I returned to Jamsah on the 4th of January.

On the 9th of January I again left Jamsah and searched Wady Beilly and the country about Abu Shaar (Myos Hormos) for petroleum, but found no signs of free petroleum, though a wide search was made to some miles beyond Myos Hormos. On this journey Mr Mitchell and I discovered a quarry of purple porphyry. The porphyry was of exactly the same quality and colour as that worked by the Romans at Jebel Duchan, for the working of which, Mr Brindley holds a concession from the Government. From careful triangulations made by Mr Mitchell it was found that the quarries at Jebel Duchan were 32 miles from the sea at Myos Hormos, and as this is the distance taken as a crow flies, the actual distance by road would be more.

The quarries discovered by us are situated in Wady Eish, a few miles North of Myos Hormos and about seven miles in a direct line from the sea. A road could easily be made at a small expense to these quarries from the sea, as there are no natural difficulties to overcome. The Romans, it would appear, did work these quarries in Wady Eish, but very much less than they did the well known quarries at Jebel Duchan. The Romans carried the porphyry from Jebel Duchan to the Nile, as is shown by the blocks of porphyry scattered along the road between Jebel Duchan and Kennah on the Nile. I could find no signs of porphyry having been carried from Jebel Duchan along the road which exists from Jebel Duchan to the sea at Myos Hormos. They appear ordinarily not to have shipped porphyry by the Red Sea, and then on through the sweet water canal, which is said to have existed in Roman times to the Mediterranean. Probably, however, a small quantity from these Wady Eish quarries was so transported, for there are blocks of porphyry scattered over this Wady up to its mouth. Many of these have no doubt been carried down by torrents, but some of them appeared to have been roughly fashioned.

I visited the Roman quarries at Jebel Duchan and was disappointed to find in what a very inaccessible position they were situated. The value of the quarries of purple porphyry at Wady Eish, situated so close to the sea coast, now that the Suez Canal can be used for its transport, ought to be considerable. The expense of making a road to the Roman quarries at Jebel Duchan, at the top of a high, and steep mountain, would, I consider, be prohibitory. The Romans could only have worked them by the unstinted use of convict labour.

On the 12th of January I returned to Jamsah, and the next day crossed in the steam launch to the village of Tor, in the Mt Sinai Peninsula. I spent 7 days in this peninsula searching for petroleum. I did not go in the direction of Mount Sinai, but went up the coast towards Suez. I was informed by my guides, and their information was corroborated by the inhabitants of Tor, that petroleum had repeatedly been found floating at low tides on the sea at Abu Durbah. I remained at this place for more than 12 hours, in the hopes that the tide would fall and enable me to trace the petroleum I had heard so much about. However, I did not find any. I was much struck by this locality where coarse sandstone crops up to the surface, and I begged Mr Mitchell to return at the next very low tides, in the hope that surface indications of petroleum might be discovered. Mr Mitchell did return, as agreed with me at the next neap tides, and he found, and has brought with him to Cairo specimens of sandstone, saturated with a bituminous oil.

I am more hopeful of finding petroleum at this point, than at any place I have visited, because the sandstone strata are so favourably situated, and I am informed by Mr Mitchell that the rock containing this bituminous oil was traced by him for at least a quarter of a mile. It is a great pity that I did not find these indications when I visited Abu Durbah. I pointed out to Mr Mitchell how favourable this spot was for a trial boring, if the surface indications of petroleum, of which we had been told, could be traced. The sandstone rock brought to Cairo was found within a few hundred yards of the spot indicated by me as a favourable one

for a trial boring. I would like, if it were possible, to dig a hole about 10 feet deep, to obtain specimens of this rock from below the surface. The sandstone submitted to me contains a large quantity of dessicated oil, and burns freely on being placed in a fire, or under the blow pipe. It is, however, from near the surface and more or less weathered, and it would be important to obtain specimens that had not been exposed to the air. A much better judgment of the find could then be formed. At the same time I would express an opinion that this would decidedly be one of the points at which a trial boring should be made. The spot selected for the boring should be at a little distance from the sea, and as distant from the mountain of igneous rock, named Jeb-el-Abu Durbah, as the surface indications of petroleum would permit.

While in the Sinai Peninsula I visited the turquoise mines near Wady Feran, and spent a day in looking over them. I did not form at all a favourable opinion of these mines. The rock was quite different in formation, from that in which the turquoises are found at the celebrated turquoise mines at Nishapur, in Persia, which I once spent six days in inspecting. The turquoises found near Wady Feran are few in number, and generally poor in quality. Mr Mitchell and I purchased some of the rough turquoises from the miners, but it did not seem to me that it would be a profitable speculation for the Government to undertake the working of these mines. After spending seven days in the Sinai Peninsula, we crossed over by the steamer "Mansourah" to Zafarana Lighthouse, where we landed and proceeded to some excavations in Wady Dakl, about 40 miles from Zafarana.

These excavations had been made, I was informed, in the hope of finding coal, but without result. From Wadi Dakl I returned in four long marches via Jeb-el-Gharib to Jamsah, searching for petroleum throughout that whole region, but except at Ras Dhib, where we had previously found small quantities of petroleum in cells in the Limestone rock, I found no further signs of oil. I reached Jamsah on the 1st of February, having on this trip alone, been out 20 days

wandering in the desert in my search. My camels and mules did not get back to Jamsah till the 3rd of February, and I determined to give them a few days rest, as they were done up by the long marches I had been making. I took advantage of this halt to explore the Island of Jubal, where petroleum was said to have been seen floating on the surface of the sea. Mr Mitchell had on one occasion himself seen a small quantity of petroleum floating on the sea at the N. E. point of Jubal, but on a subsequent visit he had been unable to find any trace of it. Having chosen a day when there was a particularly low tide, I went off in the steam launch accompanied by Mr Mitchell. We landed on the island and walked round the North-Eastern point of it, especially searching below high water mark, where oil was believed to exist, but we found none. We then embarked in the steam launch and coasted round the northern portion of the island. On the North-East side, close in to the island of Little Jubal, we found petroleum floating in considerable patches. It seemed to rise from the bottom of the sea in a manner similar to that in which petroleum gas rises from the bottom of the Caspian Sea near Baku, where I have seen it set on fire for the amusement of visitors. The quantity of petroleum seen on the East side of the island was not large, but having rounded the northern point of the island, and coasted some way down the western side, close in to the shore, we found the sea covered, for a considerable distance, with large patches of petroleum. The irridiscent colours of the oil floating on the sea first drew our attention to it. At the northern point I got into the small boat of the steam launch and carefully examined the floating oil. The Island of Jubal would not, I consider, be a good place for a trial boring, the rock being of a somewhat similar character to that found at Jamsah. The oil seen floating on the surface of the sea probably exudes from fissures in the strata in the same way as it does at Jamsah.

However, the finding of oil at two points on the coast of this island extends the area over which petroleum, in some form or other has been traced, and is thus of considerable importance.

Having been informed by telegraph that His Excellency Nubar Pacha wished me to search the country between the Red Sea and Kennah on the Nile for petroleum, I left Jamsah for Kennah on the 10th of February and arrived there on the 15th, but was unable to find any traces of petroleum in this tract of country. The next day I called on the Governor of Kennah, and asked him if he could furnish me with any information about petroleum in this part of the country. He sent for the agent of the chief of the Ababdi tribe of Bedouins, who assured me, that in all the country inhabited by the Ababdi, he had never heard of anything of the nature of petroleum being found. I had already made careful enquiries amongst the Maazi tribe of Bedouins on this subject. A son of the Maazi chief had accompanied me on my journey from Myos Hormos on the Red Sea to Kennah. The Maazi also declared that except at Jeb-el-Zayt and Jamsah, they were unaware of any signs of petroleum being found in the lands inhabited by their tribe. I heard a report from a European that he had seen pieces of bitumen floating on the surface of the sea, in a small harbour 14 miles south of El-Wedj on the Arabian coast, and I think as traces of petroleum are widely distributed on the Red Sea coast that this statement is correct. Finding no signs of petroleum near the Nile, I returned to Cairo, and arrived on the night of the 20th of February.

CHAPTER III

If a map of the Red Sea is taken, and the points, where petroleum has been found in smaller or larger quantities, be marked off, viz: two points on Jubal Island, one on the North-East, and one on the West coast of that island, one at Ras Dhib, 20 miles North of Jebel-el-Zayt, and one at Abu Durbah, 23 miles North of Tor, on the Sinai Peninsula, (besides Jamsah and Jeb-el Zayt, where it was previously known), it will be seen over what a wide extent of country I have been able to find traces of petroleum, and at all,

except Abu Durbah, in the Sinai Peninsula, actually free petroleum was found. Taking into consideration that these places are situated on a great ocean highway of commerce, the importance of settling whether petroleum exists in large quantities beneath the surface becomes one of very great importance indeed. One of the American borers at Jamsah is said to have remarked, that if oil was struck in any quantity on the Red Sea coast, Baku would become a dust heap, and I think he was right.

Professor Lesley has well said « that seeking for oil in unexplored « ground, is like seeking for tobacco in a smuggler's trunk. The « traveller and his baggage look suspicious, that is the full extent of « the custom officer's knowledge. The tobacco must be found, if at « all, with the probe. The officer's instinct may be deceived, the « trunk may have no false bottom, or the false bottom may hold no « tobacco ». In the same way it is only by trial borings, that the fact of the existence of petroleum can be proved. Knowledge and varied experience of the places, where petroleum is likely to be found, must be applied, and after all, no one can tell, except by actual experiment, whether at any given spot oil exists or not.

I am aware that the Government have expended a large sum of money already in the search for petroleum, but, I think, one of two things should be done. Either the Government should themselves undertake a boring at a point near Jebel Abu Durbah in the Sinai Peninsula, and at least at one of the other points selected by me, on the western side of the Red Sea. If this is considered undesirable, which it may be for financial reasons, I would recommend that a concession be offered to a Company to bore for petroleum at these points, and also at Jamsah, if they considered another trial well worth sinking near the American No 1 well. If a Company were formed to take over the petroleum work on the Red Sea, they should be allowed to purchase the tools and plant at present at Jamsah and Zeitieh at a reasonable price, and should be bound to pay a certain royalty on all petroleum raised by them. The concession should be given only for a moderate term of years,

when new arrangements could be made. It would be an enormous advantage to a Company, to get all the plant at present at Zeitieh, ready to their hand, and near the spot where it would be required.

I have to thank Mr Mitchell, Geological and Mining Engineer in the service of the Government, for the very efficient and kindly help he has rendered me, during the whole time I have been employed on this work.

Cairo, March 3rd 1888.

C. E. STEWART, COLONEL
Bengal Staff Corps.

LIST OF DOCUMENTS, ETC.

FORWARDED WITH THE REPORT OF PETROLEUM

BY

COLONEL C. E. STEWART

Map of the West Coast of the Red Sea, showing where borings are recommended to be made.

Plan of Jamsah showing position of the Wells.

Coloured Section of 3 Wells at Jamsah showing strata through which they were drilled.

Specimen of Lime-stone from Ras Dhib containing petroleum in small cells or cists.

Specimen of Sand-stone from Abu Durbah.

Sinai Peninsula, containing large quantity of bituminous oil.

Specimen of purple Porphyry from quarries in Wady Eish.

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